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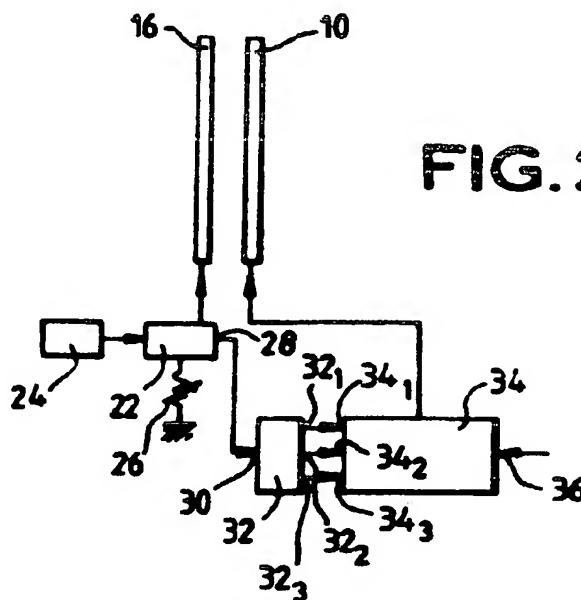
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**(54) Direct view liquid crystal display with automatic colour adjustment**

(57) The invention relates to a direct view liquid crystal display for colored images, comprising : a LCD panel (10), a light source (16) providing approximately uniform illumination of the rear face of the panel, and color circuit means (34) for controlling the colors of the panel.

The display comprises means (32) for controlling the color control means (34) with a signal representing the intensity of the light source and/or the intensity of the ambient light. This signal controls for instance the  $\gamma$  correction for each color.



## Description

The invention relates to a direct view liquid crystal display for colored images.

Liquid crystal displays (LCD) are widely used for various applications, such as Television (TV) receivers, computer displays, more particularly for portable computers called "lap top computers" and view-finders for video-cameras.

The most common displays of this type are direct view LCDs. These devices comprise generally a light source behind a LCD panel. This source is arranged to provide a uniform, or quasi-uniform, illumination of the back face of the panel, i.e. of the face which is opposite to the face which is viewed by the user.

A control element is usually provided for the manual adjustment of the intensity of the light source.

In fact it is necessary to modify this intensity when the intensity of the ambient light dies in order to obtain a good contrast of the image. The intensity of this light source must be increased (decreased) when the ambient light intensity increases (decreases).

The invention is based on the observation that the colors of the displayed images vary with the intensity of the back source and/or with the intensity of the ambient light.

According to the invention the color control circuit of the LCD comprises means for varying the color signals in view of the intensity of the back source and/or of the ambient light.

The color control circuit is preferably provided with a control input receiving a signal represents the intensity of the back source or the intensity of the ambient light.

It will be appreciated that, with the invention, it is possible to automatically obtain always the same colors for a given image.

In an embodiment of the invention the intensity or luminance of the back source is manually or automatically controlled and the control circuit of this intensity has an output connected to the control input of the color control circuit.

In an other embodiment the control input of the color control circuit receives a signal provided by an ambient light detector.

The colors may be controlled directly or through the  $\gamma$  correction circuit.

It is recalled here that television signals are usually transmitted with a  $\gamma$  correction.

This correction takes into account the non-linear features of cathode ray tubes (CRT) : CRTs provide luminance signals which vary non-linearly with the input signals. The broadcasted  $\gamma$  correction is such that CRTs provide a linear response. However the response differs from one tube to the other ; therefore each tube has further  $\gamma$  correction means. However LCDs provide naturally a linear curve ; so they are equipped with circuits which compensate the broadcasted  $\gamma$  correction.

The color control circuit is arranged in such a way that it comprises three  $\gamma$  inputs, one for each color (red R, green G, blue B) and an interface circuit is provided with an input receiving a signal representing the intensity of the back source or of the ambient light and this interface circuit has three outputs providing  $\gamma$  control signals for R, G and B.

The interface is for instance a ROM (read only memory) containing a table providing, for each value of the intensity of light, the  $\gamma$  curves for each of the three colors.

As a display for computers is generally not intended to receive TV signals, such a display will not be equipped with a  $\gamma$  correction circuit. In that case the colors will be directly controlled by the intensity of light.

Other features and advantages of the invention will appear with the description of some of its embodiments, this description being made with the following drawings, in which :

- fig. 1 is a schematic drawing of a direct view color LCD,
- fig. 2 is a block diagram of one embodiment of the invention,
- fig. 3 is a block diagram of a second embodiment, and
- fig. 4 is a block diagram of a third embodiment.

Fig. 1 represents a conventionnal direct view LCD. This display comprises a liquid crystal panel 10 having a front face 12 and a rear, or back, face 14. This back face is uniformly illuminated by light provided by the combination of : a light source 16 (for instance in the shape of an elongated lamp having several branches), a diffuser 18 between the source 16 and back face 14, and a reflector 20 at the back of the source 16.

According to the embodiment of the invention shown on figure 2 the intensity of the light source 16 is controlled by an intensity control circuit, or luminance control circuit, 22 receiving power from a power supply 24 and comprising a manually operated control element 26. This element 26 determines the intensity of the light source 16.

The intensity control circuit 22 has an output 28 connected to the input 30 of an interface circuit 32 comprising three outputs 32<sub>1</sub>, 32<sub>2</sub> and 32<sub>3</sub> which are connected, respectively, to the inputs 34<sub>1</sub>, 34<sub>2</sub> and 34<sub>3</sub> of a circuit 34 for controlling the colors and for  $\gamma$  correction of panel 34.

The input 34<sub>1</sub> receives a signal controlling  $\gamma_R$ , i.e.  $\gamma$  for the red (R) color.

The input 34<sub>2</sub> and 34<sub>3</sub> receive, respectively, signals controlling  $\gamma_G$  and  $\gamma_B$ , i.e.  $\gamma$  for green (G) and blue (B).

The circuit 34 provides the color signals R, G and B to the panel 10. The circuit 34 has an input 36 receiving the video signal.

This circuit is for instance the RGB decoder/driver sold under the reference CX A 1785 AR by Sony.

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## Claims

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various values of the signal representing the intensity of the light source and/or the intensity of the ambient light.

7. A display according to claim 6, characterized in that said memory is a read only memory. 5
8. A display according to claim 6 wherein said memory comprises a RAM memory storing the three correction curves for the present intensity of the ambient light or of the light source, these curves being provided by a central memory of a computer in which are stored all  $\gamma_R$ ,  $\gamma_G$  and  $\gamma_B$  curves corresponding to various intensities. 10

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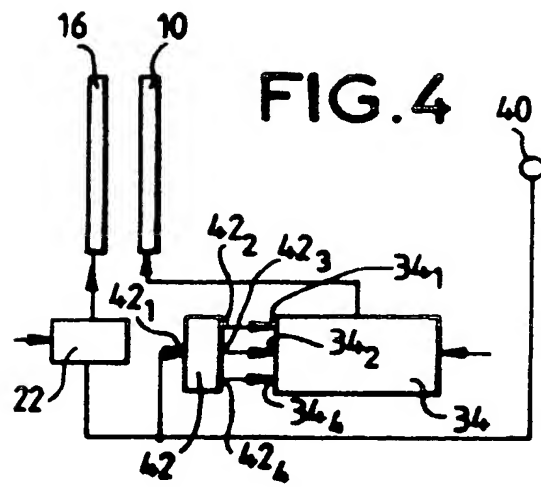
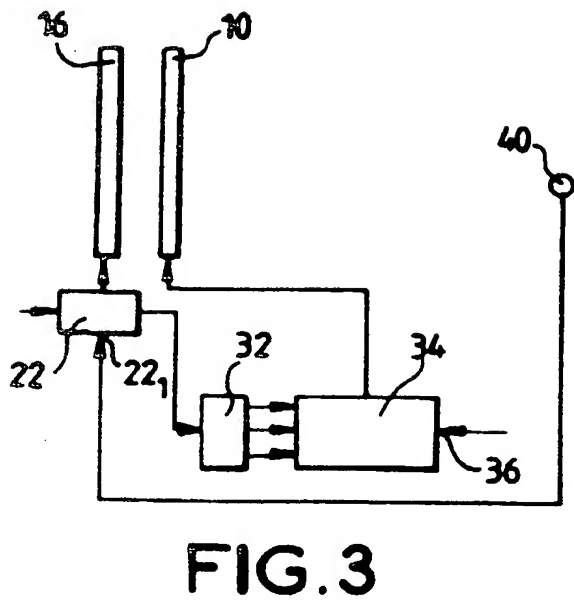
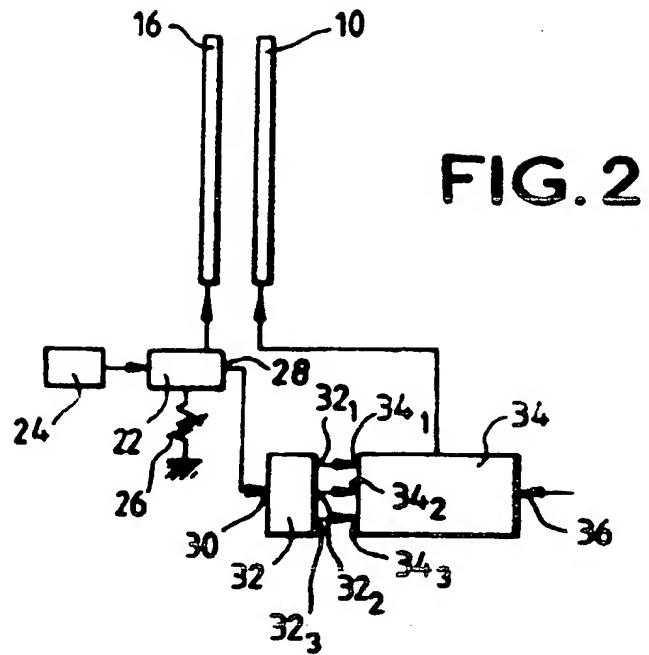
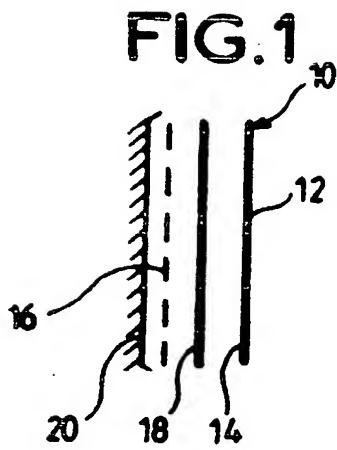
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## EUROPEAN SEARCH REPORT

Application Number  
EP 97 40 1259

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	US 5 132 825 A (S.MIYADERA) * Abstract * * column 3, line 24 - column 4, line 38; figures 3-6,11-15 * * column 5, line 28 - column 7, line 39 *	1,4	G09G3/36
Y	PATENT ABSTRACTS OF JAPAN vol. 5, no. 91 (E-061), 13 June 1981 & JP 56 035592 A (TOSHIBA CO.), 8 April 1981, * abstract *	1,4	
A	PATENT ABSTRACTS OF JAPAN vol. 96, no. 2, 29 February 1996 & JP 07 255063 A (CANON INC.), 3 October 1995, * abstract *	1,4	
A	PATENT ABSTRACTS OF JAPAN vol. 95, no. 5, 30 June 1995 & JP 07 038909 A (MATSUSHITA ELECTRIC IND. CO.), 7 February 1995, * abstract *	1,4-6	TECHNICAL FIELDS SEARCHED (Int.Cl.6) G09G
A	US 5 406 305 A (SHIMOMURA ET AL.) * Abstract * * column 4, line 4 - column 5, line 8 *	1-4	
A	EP 0 735 520 A (SHARP K.K.) * Abstract * * column 7, line 47 - column 9, line 45; figures 1-4E,10 *	2,3,5	
A	US 4 394 688 A (IIDA ET AL.) * Abstract * * column 3, line 32 - column 4, line 66; figure 1 *	2,3,5-8	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28 October 1997	Examiner Corsi, F
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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